CLAIMS

What is claimed is:

1. A cellulosic fiber composite comprising:

a cellulosic material; and

a resin binder comprising protein hydrolysates and a synthetic resin, wherein the synthetic resin is phenolic resin, isocyanate resin, or combinations thereof; and

wherein the composite contains an effective amount of resin binder so as to bind together the cellulosic material.

2. The composite as claimed in claim 1 wherein the amount of the resin binder is between about 2% and about 15% of the dry weight of the cellulosic material.

3. The composite as claimed in claim 1 wherein the amount of the resin binder is between about 4% and about 8% of the dry weight of the cellulosic material.

4. The composite as claimed in claim 1 wherein the amount of the resin binder is between about 4% and about 6% of the dry weight of the cellulosic material.

5. The composite as claimed in claim 1 wherein the amount of the resin binder is between about 4% and about 5% of the dry weight of the cellulosic material.

6. The composite as claimed in claim 1 wherein the average moisture content of the cellulosic material is between about 8% and about 35% by weight after application of the resin binder.

7. The composite as claimed in claim 1 wherein the protein is animal protein, vegetable protein, or combinations thereof.

8. The composite as claimed in claim 7 wherein the vegetable protein is soy protein.

9. The composite as claimed in claim 8 wherein the soy protein is soy isolate.

10. The composite as claimed in claim 8 wherein the soy protein is soy flour.

11. The composite as claimed in claim 8 wherein the soy protein is a blend of soy isolate and soy flour.

12. The composite as claimed in claim 11 wherein the weight ratio of the blend of soy isolate to soy flour is about 50 : 50.

13. The composite as claimed in claim 1 wherein the synthetic resin is phenolic resin.

14. The composite as claimed in claim 13 wherein the phenolic resin is phenol formaldehyde.

15. The composite as claimed in claim 13 wherein the resin binder has a weight ratio of protein hydrolysates to phenolic resin between about 10 : 90 and about 90 : 10.

16. The composite as claimed in claim 13 wherein the resin binder has a weight ratio of protein hydrolysates to phenolic resin between about 10 : 90 and about 75 : 25.

17. The composite as claimed in claim 13 wherein the resin binder has a weight ratio of protein hydrolysates to phenolic resin between about 25 : 75 and about 75 : 25.

18. The composite as claimed in claim 13 wherein the resin binder has a weight ratio of protein hydrolysate to phenolic resin between about 25 : 75 and about 50 : 50.

19. The composite as claimed in claim 1 wherein the synthetic resin is isocyanate resin.

20. The composite as claimed in claim 19 wherein the isocyanate resin is polymeric isocyanate.

21. The composite as claimed in claim 19 wherein the resin binder has a weight ratio of protein hydrolysates to isocyanate resin between about 10 : 90 and about 90 : 10.

22. The composite as claimed in claim 19 wherein the resin binder has a weight ratio of protein hydrolysates to isocyanate resin between about 10 : 90 and about 75 : 25.

23. The composite as claimed in claim 19 wherein the resin binder has a weight ratio of protein hydrolysates to isocyanate resin between about 25 : 75 and about 75 : 25.

24. The composite as claimed in claim 19 wherein the resin binder has a weight ratio of protein hydrolysates to isocyanate resin between about 25 : 75 and about 50 : 50.

25. The composite as claimed in claim 1 wherein the synthetic resin is a combination of phenolic resin and isocyanate resin.

26. The composite as claimed in claim 25 wherein the weight ratio of the isocyanate resin to the total of the protein hydrolysates and the phenolic resin is between about 25 : 75 and about 75 : 25.

27. The composite as claimed in claim 19 wherein the amount of isocyanate resin making up the composite is about 1% to about 6% based on the total weight of the

cellulosic material.

28. The composite as claimed in claim 19 wherein the amount of isocyanate resin making up the composite is about 1% to about 3% based on the total weight of the cellulosic material.

29. The composite as claimed in claim 19 wherein the amount of isocyanate resin making up the composite is about 1% to about 2% based on the total weight of the cellulosic material.

30. The composite as claimed in claim 1 wherein the synthetic resin further comprises paraformaldehyde.

31. The composite as claimed in claim 30 wherein the weight ratio of the paraformaldehyde to the total of the protein hydrolysates and the synthetic resin is between about 2 : 48 and about 15 : 35 based on 50% resin solids.

32. The composite as claimed in claim 1 wherein the synthetic resin further comprises high methylol content phenol formaldehyde pre-polymer.

33. The composite as claimed in claim 32 wherein the molar ratio of formaldehyde to phenol to NaOH of the high methylol content phenol formaldehyde pre-polymer is about 2 : 1 : 0.5.

34. The composite as claimed in claim 32 wherein the weight ratio of the high methylol content phenol formaldehyde pre-polymer to the total of the protein hydrolysates and the synthetic resin is between about 10 : 90 and about 90 : 10.

35. The composite as claimed in claim 32 wherein the weight ratio of the high methylol content phenol formaldehyde pre-polymer to the total of the protein hydrolysates and the synthetic resin is between about 25 : 75 and about 75 : 25.

36. The composite as claimed in claim 1 wherein the composite further comprises a silicone, silane, or combination thereof.

37. The composite as claimed in claim 36 wherein the silicone, silane, or combination thereof is applied as a coating to the composite.

38. The composite as claimed in claim 36 wherein the silicone, silane, or combination thereof is added to the resin binder.

39. The composite as claimed in claim 36 wherein the amount of silicone, silane, or combination thereof is between about 0.1% and about 1.0% based on the total amount of the cellulosic material.

40. A method for preparing a cellulosic fiber composite comprising:

a. mixing a protein hydrolysate with a synthetic resin, wherein the synthetic resin is phenolic resin, isocyanate resin, or combinations thereof, to produce a resin binder;

b. mixing the resin binder with a cellulosic material to form a cellulosic material/resin binder blend;

c. felting the cellulosic material/resin binder blend to form a low moisture-content mat; and

d. pressing the low moisture-content mat at an elevated temperature and pressure, producing the cellulosic fiber composite.

41. The method of claim 40 wherein the amount of the resin binder is between about 2% and about 15% of the dry weight of the cellulosic material.

42. The method of claim 40 wherein the amount of the resin binder is between about 4% and about 8% of the dry weight of the cellulosic material.

43. The method of claim 40 wherein the amount of the resin binder is between about 4% and about 6% of the dry weight of the cellulosic material.

44. The method of claim 40 wherein the amount of the resin binder is between about 4% and about 5% of the dry weight of the cellulosic material.

45. The method of claim 40 further comprising adjusting the moisture content of the cellulosic fiber composite to a predetermined amount.

46. The method of claim 40 wherein the average moisture content of the cellulosic material is between about 8% and about 35% by weight after application of the resin binder.

47. The method of claim 40 wherein the protein hydrolysate is made by hydrolyzing a source of protein with sodium carbonate.

48. The method of claim 40 wherein the protein is animal protein, vegetable protein, or combinations thereof.

49. The method of claim 48 wherein the vegetable protein is soy protein.

50. The method of claim 49 wherein the soy protein is soy isolate.

51. The method of claim 49 wherein the soy protein is soy flour.

52. The method of claim 49 wherein the soy protein is a blend of soy isolate and soy flour.

53. The method of claim 52 wherein the weight ratio of the blend of the soy isolate to the soy flour is about 50 : 50.

54. The method of claim 40 wherein the synthetic resin is phenolic resin.

55. The method of claim 54 wherein the phenolic resin is phenol formaldehyde.

56. The method of claim 54 wherein the resin binder has a weight ratio of protein hydrolysate to phenolic resin between about 10 : 90 and about 90 : 10.

57. The method of claim 54 wherein the resin binder has a weight ratio of protein hydrolysate to phenolic resin between about 10 : 90 and about 75 : 25.

58. The method of claim 54 wherein the resin binder has a weight ratio of protein hydrolysate to phenolic resin between about 25 : 75 and about 75 : 25.

59. The method of claim 54 wherein the resin binder has a weight ratio of protein hydrolysate to phenolic resin between about 25 : 75 and about 50 : 50.

60. The method of claim 40 wherein the synthetic resin is isocyanate resin.

61. The method of claim 60 wherein the isocyanate resin is polymeric isocyanate.

62. The method of claim 60 wherein the resin binder has a weight ratio of protein hydrolysates to isocyanate resin between about 10 : 90 and about 90 : 10.

63. The method of claim 60 wherein the resin binder has a weight ratio of protein hydrolysates to isocyanate resin between about 10 : 90 and about 75 : 25.

64. The method of claim 60 wherein the resin binder has a weight ratio of protein hydrolysate to isocyanate resin between about 25 : 75 and about 75 : 25.

65. The method of claim 60 wherein the resin binder has a weight ratio of protein hydrolysates to isocyanate resin between about 25 : 75 and about 50 : 50.

66. The method of claim 40 wherein the synthetic resin is a combination of phenolic resin and isocyanate resin.

67. The method of claim 66 wherein the weight ratio of the isocyanate resin to the total of the protein hydrolysates and the phenolic resin is between about 25 : 75 and about 75 : 25.

68. The method of claim 60 wherein the amount of isocyanate resin making up the composite is about 1% to about 6% based on the total weight of the cellulosic material.

69. The method of claim 60 wherein the amount of isocyanate resin making up the composite is about 1% to about 3% based on the total weight of the cellulosic material.

70. The method of claim 60 wherein the amount of isocyanate resin making up the composite is about 1% to about 2% based on the total weight of the cellulosic material.

71. The method of claim 40 wherein the synthetic resin further comprises paraformaldehyde.

72. The method of claim 71 wherein the weight ratio of the paraformaldehyde to the total of the protein hydrolysates and the synthetic resin is between about 2 : 48 and about 15 : 35 based on 50% resin solids.

73. The method of claim 40 wherein the synthetic resin further comprises high methylol content phenol formaldehyde pre-polymer.

74. The method of claim 73 wherein the molar ratio of formaldehyde to phenol to NaOH of the high methylol content phenol formaldehyde pre-polymer is about 2 : 1 : 0.5.

75. The method of claim 73 wherein the weight ratio of the high methylol content phenol formaldehyde pre-polymer to the total of the protein hydrolysates and the synthetic resin is between about 10 : 90 and about 90 : 10.

76. The method of claim 73 wherein the weight ratio of the high methylol content phenol formaldehyde pre-polymer to the total of the protein hydrolysates and the synthetic resin is between about 25 : 75 and about 75 : 25.

77. The method of claim 40 wherein the resin binder further comprises a silicone, silane, or combination thereof.

78. The method of claim 40 that further comprises applying a coating to the composite, wherein the coating is a silicone, silane, or combination thereof.

79. The method of claim 77 wherein the amount of silicone, silane, or combination thereof is between about 0.1% and about 1.0% based on the total amount of the cellulosic material.

80. The method of claim 78 wherein the amount of silicone, silane, or combination thereof is between about 0.1% and about 1.0% based on the total amount of the cellulosic material.

81. A method for preparing a finished cellulosic fiber composite article comprising:

a. mixing a protein hydrolysate with a synthetic resin, wherein the synthetic resin is phenolic resin, isocyanate resin, or combinations thereof, to produce a resin binder;

b. mixing the resin binder with a cellulosic material to form a cellulosic material/resin binder blend;

c. felting the cellulosic material/resin binder blend to form a low moisture-content mat; and

d. molding the low moisture-content mat at an elevated temperature and pressure, producing the finished cellulosic fiber composite article.

82. The method of claim 81 that further comprises applying a laminate overlay to the finished cellulosic fiber composite article.

83. A finished cellulosic fiber composite article prepared by the method comprising:

a. mixing a protein hydrolysate with a synthetic resin, wherein the synthetic resin is phenolic resin, isocyanate resin, or combinations thereof, to produce a resin binder;

b. mixing the resin binder with a cellulosic material to form a cellulosic material/resin binder blend;

c. felting the cellulosic material/resin binder blend to form a low moisture-content mat; and

d. molding the low moisture-content mat at an elevated temperature and pressure, producing the finished cellulosic fiber composite article.

84. The article as claimed in claim 83 that further comprises a laminate overlay.